A SIMPLE SOIL SAMPLER AND ITS USE AS A PERMEAMETER

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The efficient collection of samples of undisturbed soil depends partially upon the characteristics of the sampling tool. Because of their bulk the available soil samplers 1/ are not easily used, especially where many samples are required. Furthermore, the form of the shell containing the sample is not well adapted for laboratory measurements on permeability. A modified soil sampler has been designed to overcome these difficulties.

Figure 1.--The parts of the soil sampler.

This sampler consists of a shell to encase the soil core, a frame to guide the shell into the soil, and a pressing block. The cylindric shell is a basally truncated, crown-type, seamless beer can, stamped from a relatively heavy gauge iron sheet.

After removal of the bottom of the can the basal edges are sharpened for cutting. This must be done carefully, because any imperfections in this cutting edge will reduce the quality of the soil core removed. The frame is a block of wood drilled to accommodate the shell. The wooden pressing block is shaped to fit the cone-like top of the shell (fig. 1).

To obtain samples the soil surface is leveled, the frame is positioned, and the shell is placed in the circular opening of the frame and is pressed into the soil. Pressure is applied gently and parallel to the axis of the shell. Roots and soft rock can be successfully cut by rotating the shell about its axis. The shell is dug out with a spade. A number two stopper conveniently seals the mouth of the shell, and the base can be sealed with a 4-inch square of aluminum foil secured by a rubber band.

1/ Coile, T. S. "Soil Samplers," Soil Sci., 42:139-142. 1936.

The inside diameter of the shell is nearly constant at 70 millimeters. The height of the core will vary by ±5 percent because the shell cannot, practically, be inserted to a constant depth in the soil. By means of a suitably mounted scale and index pointer the height of individual cores may be quite easily measured without removal from the shell.

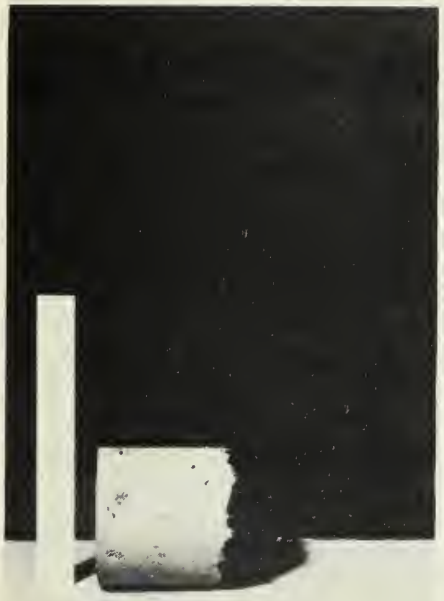

Figure 2.--The core removed from the sampler.

The shape and condition of a moist core are shown in figure 2. The base, smoothed with a knife at time of removal from the soil, is a plane surface. The upper surface of the core is as nearly a plane as is possible to secure from the original soil surface. Sometimes the process of removing the core from the sampler shell also causes irregularity in the upper surface.

Core compression is important where very plastic soils are sampled or where soils containing roots and soft rock are encountered. Compression can be minimized by rotating the shell while pressing it into the soil. If shells are inserted to a fixed depth, compression can be roughly expressed by the core height.

The sampler can be used to measure apparent specific gravity, soil moisture content, and root concentrations. Since the observational error of a single measurement may be ±10 percent, a number of observations are required to establish a mean value of acceptable error. Hence, the sampler cannot be expected to replace the more exact techniques that are used where a limited number of samples must suffice.

To use the sampler as a permeameter the base of the shell and the contained core are covered with a circle of muslin held in place by a heavy rubber band. A circular piece of linen can be inserted through the neck of the shell to protect the upper surface of the core from disturbance by inflowing water. The soil sample is saturated and connected with a hydraulic system, which applies water under constant pressure (fig. 3).

The reservoir (1) is supplied from a water faucet or distilled water source. A principal siphon (2) maintains a flow of water to the leveling flask (4), while the air-return (3) is open above the water level in the flask. The rise of water in the air-return brings the system to equilibrium, and the flow of water to the flask ceases. The air-return tube is of large diameter to allow rapid but short-period drainage from the leveling flask. Water is carried to the permeameters by means of individual siphons (5). The leachate is collected in graduated cylinders. Other

outlets in the system serve to equalize pressures while filling the reservoir and to "bleed" the air accumulations at the siphon crests.

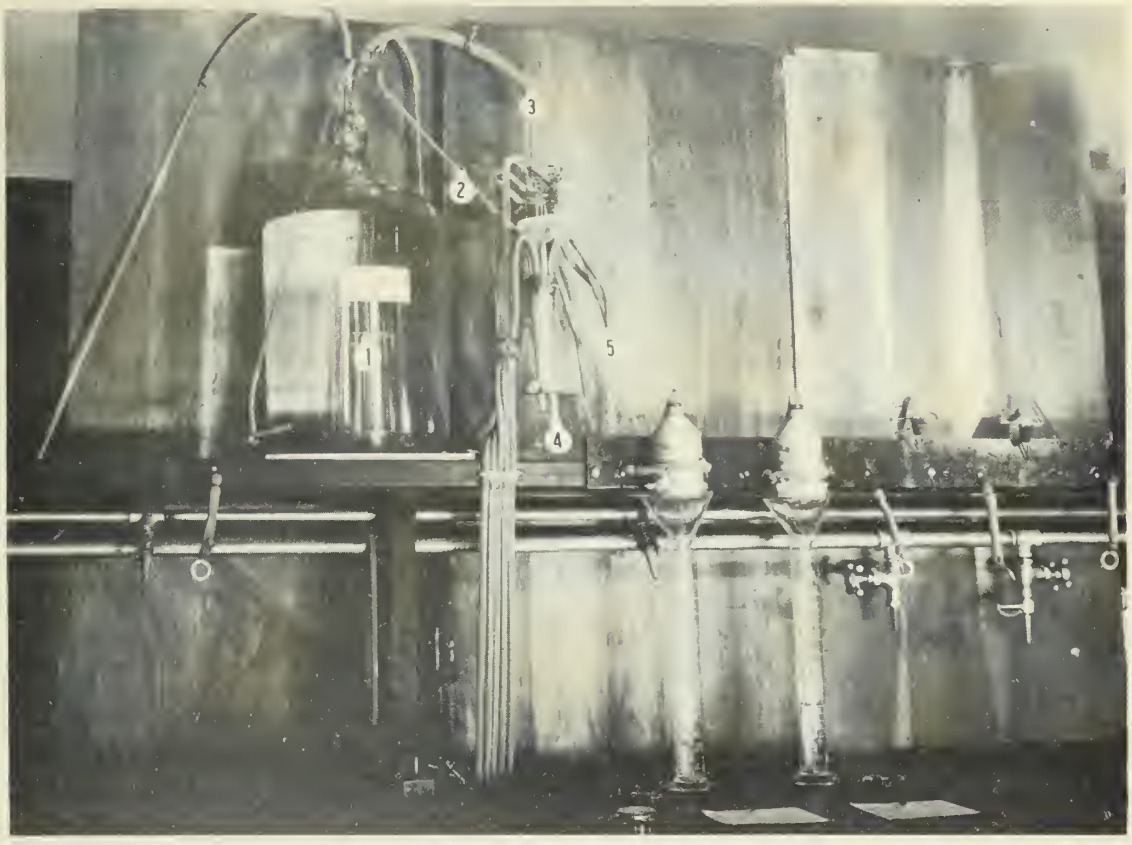

Figure 3.--Applying water to the permeameter at constant head.

Permeabilities obtained from natural soil cores are typically variable. The magnitude of variation will cause the investigator to doubt the reliability of certain measurements. This doubt may be partially resolved by testing for leakage along the core-shell border. To test for leakage (following permeability trials), invert the permeameter containing the core and cover the base with liquid soap. Apply air at the cap under 2 centimeters pressure and observe the location of bubbles. Excessive bubbling at the perimeter may indicate an imperfect sample.

A modified soil sampler has been described. The sampler is light in weight, easy to use, and can be constructed from commonly available materials. The soil cores obtained are apparently of high quality.

The sampler shell is a permeameter. A method for applying water (at constant head) to the sampler has been outlined and a method for testing for imperfect contact between the permeameter shell and encased core has been described.

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